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The American Biology Teacher

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A Message to Biology Teachers

It is generally conceded that it is practically essential in present-day teaching to keep posted on the current literature in any particular field. Yet no busy teacher possibly could read all of the important papers in the original even if the many journals published throughout the world were available. It was for this reason that a group of prominent biologists organized *Biological Abstracts* back in 1926. Now this cooperative undertaking is abstracting and indexing annually more than 30,000 significant contributions to the biological sciences.

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The American Biology Teacher

Vol. 13 DECEMBER, 1951 No. 8

Control Experiments

HENRY T. HARVEY
State Teachers College, Florence, Alabama

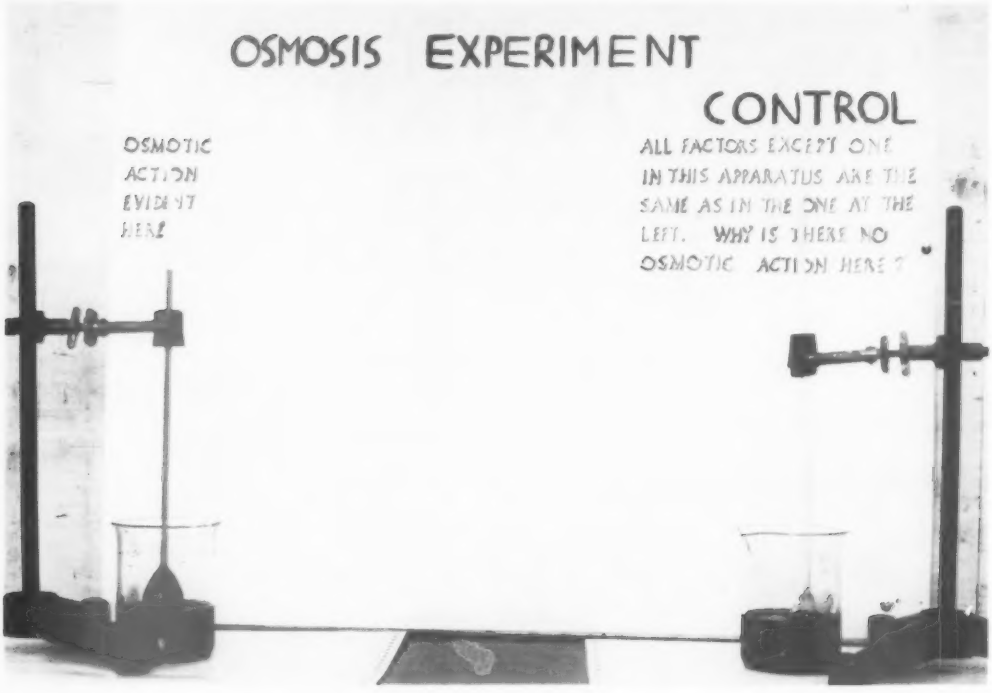
What to teach in any science course is a vexing problem for the conscientious teacher, and one which may be truly frustrating. Time does not allow the instructor to cover everything in the average textbook with all the attention that each detail deserves; some pages and even chapters often have to be omitted. Which scientific principles to present to the class and which to sacrifice is a difficult problem to solve, for they are all important, all inter-related and indispensable to a satisfactory appreciation of the whole of a science. To a lesser degree this is also the problem of the writers of textbooks for they are limited by printing costs, textbook space and popular conceptions of what a science textbook should be like in size and content. They too mush choose and reject, condense and trim.

Yet there is an irreducible minimum; topics that by their very nature must be covered both in the textbook and by the teacher. This problem of where to draw the line may be solved by applying the question: Is the subject matter in question absolutely necessary to a knowledge of many fundamental scientific principles?

Most students, whether in high school or college, study but one year of a science. Thus, whether it be biology, general science, physics or chemistry, it is essential that this course be, as much as possible, a course in general science covering broad scientific principles basic to all science. A knowledge of molecular motion, for example is indispensable to the most elementary comprehension of almost any science.

Another topic which I believe fits into this category is that of control experiments, yet I have been dismayed to find it mentioned in only two* of the twenty-three high school and college science textbooks that I have examined. Ours is an age of research, of scientific experimentation in which control experiments are vital. To leave this subject out of any science course is as foolish as

* MOMENT, *General Biology*, Appleton-Croft-Century; DE LAUBENFELS, *Life Science*, Prentice-Hall.


OSMOSIS EXPERIMENT
CONTROL
OSMOTIC ACTION EVIDENT HERE
ALL FACTORS EXCEPT ONE IN THIS APPARATUS ARE THE SAME AS IN THE ONE AT THE LEFT. WHY IS THERE NO OSMOTIC ACTION HERE?

that of teaching astronomy without some discussion of telescopes; for just as most of our knowledge of the stars has come through that instrument so will nearly all future advance in this science take place through it. The same is true in regard to control experiments. Modern science was born out of experiments and future progress in science will be made through experimentation. Of course, when we speak of an experiment we include the control experiment, which is an integral part of any experiment. Indeed, students should be made to realize that unless controls are used an experiment may lead to disastrous conclusions.

Webster's Collegiate Dictionary defines a control experiment as "An experiment to check the results of other experiments as by maintaining identical conditions, except for one varied factor whose causal significance can thus be inferred."

Students should be made aware of this important tool of scientists, not because of a mere academic formality, nor because we expect any large percentage to become research scientists, but because of its usefulness to the student in his daily life. Americans have the reputation of being an inventive people whose acuity of observation of natural phenomena and their interpretation has not been limited to the laboratory but has included the entire theatre of man's activities—the kitchen, the farm, the shop, the street.

Suppose then that a student is applying fertilizer to his garden. If he has been made conscious of controls, he will set aside a portion of the land having exactly the same growing conditions to develop without any fertilizer. Probably the treated land will produce superior crop yields, but this may not always be so. On such a small scale, of course, no true scientific conclusions

could be arrived at, yet this matter of control experiments is a technique for sharpening and utilizing one's natural curiosity and perispicacity to a degree not otherwise possible. Sometimes this pays off with a discovery that is worth more than all the pains taken to teach it.

These controls are also essential in doing scientific detective work whether dealing with the reason for the unsatisfactory quality of a run of paper in a paper mill or finding what caused the basement lights to go out. Keeping in mind that all one needs to do in one's search for such a causal agent is to vary one factor at a time while maintaining identical conditions, it is easy to see how such a procedure can simplify and accelerate a solution to such problems as contrasted with a blind hit and miss method.

Of immediate benefit to science students is the ease with which they can understand an experiment when their attention is called to its control. In demonstrating osmosis, for example, instead of the usual single set-up, it is much more revealing to place two osmosis apparati side by side; one with water on both sides of the semi-permeable membrane and one with the accepted syrup and water in their proper places. My own experience has been that students remember such experiments much better when there is a control or two with which they may make comparisons.

In conclusion the writer would say that the subject of control experiments has been neglected by textbook writers and by teachers. If such an important scientific tool is given its proper place in teaching, satisfying results, both immediate and far reaching, will accrue.

Teaching Aids for Health — Pitch, Loudness, Quality

BEA BUZZETTI

Bremerton Senior High School, Bremerton, Washington

So many people raise the pitch of their voice when it would be much better to increase the volume of air in motion. This experiment will call attention to the difference between pitch and intensity and initiate thought on use of the voice.

Materials—A Sonometer (borrow from the Physics lab). A few tuning forks.

Sound the tuning forks to illustrate a true simple tone. Both pitch and loudness can be demonstrated with these and with the string on the sonometer. Tuning forks are labeled as to the number of vibrations per second. They can be struck easily and hard to demonstrate intensity. Pluck the string on the sonometer; now shorten it with a bridge and pluck again to demonstrate pitch. Pluck it easily and with more energy for intensity.

Follow up this experiment with a discussion of deafness. The most important point to stress is that a vast majority of hard-of-hearing people lose their hearing in the high pitches first. This is the reason that grandma never hears what is intended for her but always hears those remarks which we wish to keep from her. It is not her fault but yours. You speak loudly to her but since you are not aware of the difference between pitch and intensity you raise your

voice and she is deaf to the high tones. That which she is not to hear is spoken in a low pitched tone and she is not yet deaf to those tones.

Perhaps the following experiment in quality has no applicable value in a health class but it is most interesting while we are on the subject. To explain quality tell them that though a tuning fork gives but one simple tone (usually represented by a sine curve), all other musical tones are complex, being made up of a fundamental and many overtones of different intensities. The number and loudness of the overtones depends upon the shape of the instrument and the material of which it is made. Pluck the string to sound the fundamental. Now gently "tamp" it in the center by touching it lightly with the finger and the first overtone will be brought out (one octave above it). The string really vibrates as a whole (fundamental), in halves, thirds, etc., at the same time.

Reading Project in Biology

MELVIN A. HINTZ

South Milwaukee High School, South Milwaukee, Wisconsin

"More students are enrolled in the general biology course than in any other science course now offered in high school."[1] This challenging statement should cause biology teachers everywhere to ask themselves, "what have I done or what am I doing to make biology more of a 'living' science for the boys and girls I teach?" Are we as teachers making biology the science which fits everyday needs? A positive answer to these questions calls for constant striving on the part of the teacher to make students more conscious of the important role biology plays in their daily living, by using a variety of teaching techniques.

Through the years one of our most successful projects has been a reading project, BIOLOGY IN THE PRESS, conducted as a part of the regular class work. The project itself is not difficult to administer and does not require more than an hour of the teacher's time each week. At the beginning of the semester each student is provided with a mimeographed instruction sheet listing the following points to be considered as a guide to effective reading: I. Purpose, II. Method, III. Approved Magazines, IV. How to write the project.

Proceeding after the foregoing pattern, each student is required to read one newspaper article and one magazine article of a biological nature each week. In order to safeguard the scientific quality of magazine reading material used, the list is limited to the following which are available in the classroom or school library: *Science News Letter*, *Science Digest*, *Nature Magazine*, *Natural History*, *Today's Health*, *Wisconsin Conservation Bulletin*, and *Scientific American*. This limited list does not mean that valuable scientific material is not to be found in other magazines. For example, *National Geographic* has excellent material. *Life* magazine has good material, but this is better suited for stimulating interest by use on bulletin boards, than for the reading program.

The report is made on a three-by-five card which can be printed or mimeographed. Following is a sample:

[1] WEAVER, "A Message from the President," *The Am. Biol. Tchr.*, Vol. 13, No. 1, p. 12.

BIOLOGY IN THE PRESS

Name _____ No. ___

Date _____ Assignment ____ Grade _____ %

Magazine _____ Date _____

Article read _____ Pages _____

Newspaper _____ Date _____

Article read _____ Inches _____

On the reverse side of the card the student writes a brief summary of each article read. We urge students to print or type their reports and stress neatness, accuracy and punctuality. The reports are turned in at class time on the date stamped on the report blank and are not accepted after this time except in cases of legitimate absence. Set a time and do not accept late reports if you want the plan to work smoothly.

A master sheet on which are recorded the points for each week's readings is made for each class. The reports are graded on a 0–33 point basis. Every three weeks the points are added and this constitutes one of the assignment grades for a six-weeks' period. The general code in our school each week includes 33 points if both articles are good and the report is typed, 30 points if in ink, 25 points if in pencil, 15 points if the student has only one article.

This project, like all projects, may present some particular problems. At first, students will not know how to find good newspaper articles. The teacher can aid much in the development of "scientific news sense" if he will post on the bulletin board for the students to check some good articles he has clipped. If a check test or oral report is given once in a while, it will discourage students from copying reports from one another. As the teacher checks the reports any evidence of repeated copying will soon be detected.

One may ask "what does a project of this type accomplish?" Experience in our school indicates that: *1.* It causes students to become aware of the fact that biology plays a very important role in their everyday living; *2.* It keeps them informed of the latest developments in the field of biology; *3.* It develops keen observation and, above all, aids in forming good habits for later reading. As was mentioned before, the administration of this reading program does not become a time-consumer for the teacher, but encourages the student to intelligently read current newspapers and magazines. Education becomes increasingly valuable in a practical way only in so far as it becomes a part of everyday life.

A piece of wood (canoe birch) set in water in a specimen bowl and covered with a bell jar. The mold is the mycelium of the birch polypore, *Polyporus betulinus*. Photo by H. E. Stork.

FUNGUS PLANTS

When mushrooms, puff balls, shelf fungi and similar Basidiomycetes are illustrated and described in textbooks there is a danger that the student will get the notion that such a spore-bearing structure is the whole plant. It seems important then to emphasize the fact that this is only the end result of long periods of growth of the mycelium in the substratum. In wood-decay fungi, for example, years of growth of the mold in the wood may precede the formation of the spore body on the outside.

We have found it helpful in the winter when there is little other exciting material available from outdoors to have students bring in pieces of wood that show signs of decay, set them on end in a specimen dish of water, and cover with a bell jar. In the course of weeks, the decay mycelium in the wood will make growth and show itself on the outside. In some cases the spore bodies of various species will form after a longer period of time, though this spore body formation is dependent on combinations of factors, some of which may be lacking. Sporangia of myxomycetes, some of the smaller mushrooms and some shelf fungi have responded with spore bodies. But even the mold itself will serve to impress the students with this phase of the life history of the plants. The myxomycetes appear best from wood that is so far decayed that it falls apart, while for the mycelium types the wood should be only started in its decay.

Any device may be used that keeps the wood in a moist atmosphere at room temperature with part of the wood continually in contact with water. Twigs or pieces of wood split from larger stems may be put into test tubes containing a few cc. of water and the tubes closed with cotton plugs. Any pieces of wood that do not respond with growth after several weeks may be discarded for others.

Let the student think through the importance of wood-decay organisms in the economy of nature. What would happen in the world of life if there were no organisms that produce enzymes capable of breaking down cellulose? What organisms are able to produce such enzymes?

We have found the Encyclopedia Britannica film *Fungus Plants* very helpful in showing the growth of mycelium and emphasizing its importance.

Harvey E. Stork,
Carleton College,
Northfield, Minnesota

Another Angle on Nutrition

RICHARD F. TRUMP
Senior High School, Ames, Iowa

It's easy to determine whether students know how many little calories there are in a big Calorie. But it's hard to determine whether they are improving their eating habits. Maybe that is why so much of our teaching is less practical than it should be.

While listening to a radio program on nutrition, I was impressed with the notion that our teaching of dietary problems could be simplified and improved at the same time. Martha Duncan of Station WOI, Iowa State College, was reading a menu that an Iowa farm family had submitted for criticism; she then discussed the changes recommended by nutrition experts.

Through the kindness of Dr. Ercel S. Eppright, Head of the Department of Foods and Nutrition, the original menus submitted by five different families, along with the revised menus and comments were used as source material in biology classes at Ames High School. Results were encouraging.

After studying basic material in texts and bulletins,* the students were given copies of the original menus. They revised the menus as they thought desirable. Then, in class discussion, their revisions were compared with the recommendations submitted by the specialists.

The material, essentially as presented on the radio program, is reprinted here. Note that the menus are for rural families, whose calorie requirements are higher than for most urban families.

*One of the more effective bulletins used was "Americans Are Gambling With Their Health," available from Westinghouse Electric Corporation, Mansfield, Ohio. It describes a study conducted by Pennsylvania State College.

Original Menu	Revised Menu	Comments
	I	
Bread, butter Sirup Coffee	Prunes French toast Butter Sirup or honey Coffee, milk	French toast a good way to make bread more nutritious and tasty. Fry it crisp and golden brown.
Hamburger Boiled potato Bread, butter Coffee	Hamburger, bun Relish Lettuce, onion, carrot strips Milk Stewed dried apricots Oatmeal cookies	Nothing wrong with a good hamburger. Heat the bun before serving. Add green vegetables rather than potatoes. Have milk, even if you have coffee, for a hamburger meal needs it to be complete. The apricots are important.
Hamburger Riced potatoes Bread Vanilla pudding Coffee	Smothered liver and onions Riced potatoes Seasoned stewed tomatoes with toasted croutons Vanilla pudding with jelly topping Coffee	Should vary meat as well as bread and vegetables. Make tomatoes tasty; they are important. Vanilla pudding will look more tempting with a bit of jelly on top.

Original Menu	Revised Menu	Comments
	II	
Sliced oranges Ham Scrambled eggs Toast Coffee	Sliced oranges Ham Scrambled eggs Toast, butter Coffee, milk	
Roast beef Browned potatoes Buttered peas Home-made rolls Pickles Coffee Apple pie Cheese	Roast beef Browned potatoes Creamed peas Rolls Pickles Coffee, milk Fruit cup	Use more creamed vegetables in order to increase much-needed milk. Replace pie and cheese with fruit cup to keep calories down.
Scalloped potatoes Buttered beets Bread Ham Coffee Bananas Cup cake	Oyster stew Crackers Relish plate Mixed crisp vegetables Cup cake with lemon sauce	A good combination for a light meal, needed after the heavy breakfast and noon meal. This day's menu is good but is too much except for very active person.
	III	
Grapefruit juice Fried egg Buttered whole wheat toast Grape jelly Coffee	Add milk	A good standard menu. Only improvement would be to add a small glass of milk. This is desirable in breakfasts which do not include cereal and milk.
Meat loaf Gravy Mashed potatoes Baked beans Lettuce, pineapple salad White bread Pumpkin pie Coffee	Meat loaf Gravy Mashed potatoes Buttered beets Lettuce salad Bread Pumpkin pie Coffee, milk	Save the beans for supper; not a good combination with potatoes. Use French dressing with the lettuce. Save the pineapple for later.
Baked beans Potato salad Milk Coffee	Baked beans Relish Crisp celery, carrots, green pepper, sliced onion Cornbread, honey Milk	Beans and hot corn bread, a good combination. Make cornbread with yellow corn meal. No dessert is needed because one can finish up with honey on the cornbread.

Original Menu	Revised Menu	Comments
	IV	
Oatmeal Sugar, top milk Toast Coffee	Add tomato juice	Cereal and milk breakfast excellent. Add tomato juice for vitamin C; it will be improved in flavor and nutritive value by adding a little lemon juice.
Sausage Mashed potatoes Creamed corn Lettuce salad Bread, butter Coffee	Sausage Creamed corn Waldorf salad Rye bread, butter Coffee Chocolate pudding and cookie or chocolate pie	Glad to see some pork. Corn good with sausage. Save potatoes for evening meal this time. Add color to salad with small pieces of apple unpeeled.
Eggs, poached Potato cakes Cookies Coffee	Eggs, poached Potato cakes Lettuce salad Hot whole wheat muffins, jam	Potatoes left over from yesterday; well seasoned and fried to golden brown.
	V	
Pancakes Sirup Butter Oatmeal, sugar, milk Coffee	Grapefruit Pancakes Butter Sirup Coffee Milk	Since pancakes are largely a cereal food, substitute fruit for oatmeal. With omission of oatmeal, add a small glass of milk for both old and young.
Beefsteak Potatoes Gravy Bread, butter Slaw Coffee	Beefsteak Mashed potatoes Gravy Bread, butter Slaw Coffee Tapioca pudding	A pretty good menu as it stands. Main meal is a bit more satisfying with a dessert. Also since no food was prepared with milk, suggest a milk dessert. Slaw is a good dish; pep it up with sour cream dressing. Add chopped carrots for color, flavor, and nutrition.
Eggs Fried potatoes Bread Butter Peach sauce Tea	Scrambled or deviled eggs Creamed corn Brown bread, butter Peach sauce or canned peaches Milk	Potatoes a good food but once a day sufficient. Add some cheese to the corn; let it melt, and if you like the flavor chip in some pimento or green pepper. Season well. Vary the bread; if you used white at noon, use brown for evening meal.

How to Succeed in the Study of Biology

M. C. LICHTENWALTER *
Lane Technical High School, Chicago, Illinois

The "success suggestions" of this article were prepared for the beginning biology student. Their purpose is to aid him to accomplish more easily his objectives of study. They are an over-all pattern of thinking-acting-accomplishing for biology students. The list includes those points which are different from the other subjects he may have at this time. It does not include general aids to study, these may be obtained from any good book on the subject.

ADOPT THE BIOLOGY ATTITUDE. Biology is a study of living things, concentration of information on life and living. Many of its facts and principles are obvious, others are technical. It is your business during your biology study to make a personal issue of each of the problems with which you are confronted and ask the question, "How does this apply to me?" See for yourself how you can benefit by the study of the biological situation with which you are dealing.

LEARN THE LANGUAGE OF BIOLOGY. The study of biology might be likened to the study of a new language. There are many new words and phrases to master. Some ordinary words take on new meanings; become familiar with these. You should not only be able to understand them but you should also be able to use them to your advantage. Most textbooks have a glossary of words and biological phrases; find its location in the book and refer to it often. Some books have word lists at the end of each chapter or problem. Make the words on the list your own.

MAKE PLANIMAL OBSERVATIONS. Seek out the location of the nearest conservatories, parks, zoos, and museums, and visit them often. Observe the plant or animal specimen and associate its name with it. On your next visit try to recall this name if possible without benefit of the name plate. For each specimen try to amass a reserve supply of knowledge.

TAKE FREQUENT HIKES after school hours and on week ends. Study the living things when you visit: wooded areas, lakes, streams, rivers, and open fields. Observe the types of life found in each area. Find the answer to the problem of why certain living things are found in a particular area and not in another. Take notes, sketches, draw, and record important data when specimens are encountered. If you do not care to do this type of thing, at least bask in the beauties of nature and enjoy yourself in the meanderings of your field-trip.

PURCHASE IDENTIFICATION GUIDES. These are often reasonably priced in variety-dime stores, hobby shops, and bookstalls. The identification guides may be in book form, large printed charts, loose-leaves, and card sets. They cover various topics: birds, trees, mammals, insects, and others. These are economically priced so you should purchase as many different kinds as possible. They do not become outmoded nor obsolete and can be shared with friends or members of the family. They are compact for the pocket on a field trip, or duffel while in camp and may be used for special reports or as reference if the information desired is not too technical.

MAINTAIN A NATURE SCRAPBOOK. Include in this any current literature available on the subject of plants and animals. These are found in newspapers, Sunday supplements (some with excellent life like coloration pictures), magazines, and circulars. A loose-

* "The Old Fossil" of *Biology Laboratories* received several requests to expound on the theme of this article, the title of which was mentioned in the issue of April 1950. This is in response to these requests.

leaf scrapbook is best because after a few articles have been collected they may be shifted and grouped according to subject matter. (It should be noted that the cutting up of magazines devoted entirely to biology should be discouraged; such form the basis of a comprehensive biology library.) All special reports and extra-credit work should find a permanent place in your scrapbook, after they have been used for class purposes.

Assume a questioning attitude regarding all phases of biology. Those points which bother you should be formulated into one or more well worded questions. Keep these in mind and ask someone in authority to explain them. The questioning attitude should always be maintained throughout life. It is one of the most valuable assets to your learning technique. Even those in authority use it periodically to check their thinking.

Collect specimens—leaves, insects, seeds, fruits, bark, buds, twigs, shells, and fossils. Any biology materials of a hard texture make excellent collector items. Biologicals of a soft texture must be preserved in fluids such as alcohol, formaldehyde, or AFA. Fluid preservation is not difficult, provided a few simple rules are followed in the process. It is well within the realm of any interested secondary school student's ability to collect and preserve specimens.

Rear pets and plants. Both of these provide an interesting avocation. Pets may be any of a varied type of animal life from fish to mammals. A great deal may be learned through feeding, rearing, and breeding of these pets. The growing of plants from seeds and from cuttings is also educational. Soilless culture may be tried on a small scale (just as it is done commercially in greenhouses) with excellent results. There are kits and books on the market to aid you in the work.

Join organizations, such as Boy and Girl Scouts, nature study clubs, and others which bring together people of a like interest. If you join one or more of these you not only will learn a great deal about biology but also the people you meet may become lifelong friends through the contacts.

Write for literature. The advertising departments of many commercial houses distribute literature on different phases of nature and living things. Ask for these materials, they are generally free. Such may include: bird pictures, extinct animals, and even different phases of health, food, and vitamins. This is in addition to the materials obtained from seed houses and manufacturers of garden products, equipment, and insecticides. The State Conservation Department will have many publications; the Agriculture School of your state university publishes much material on crops, and care and feeding of animals; the federal government printing office has several catalogues each of which contains thousands of pamphlets, many no doubt in your field of interest. *The Naturalists' Directory* contains thousands of names and addresses of people throughout the world, with their particular fields of interest listed. Contact your County Agent for local or regional know-how.

Become a voracious reader. The field of literature for biology extends from deeply engrossing adventure stories with a nature setting and biological background to technical literature. The field is so broad you can find many things of interest to you: be sure to read your fill of these. Do not confine your concurrent learning enterprises to the subject matter being taught in your biology classroom for a particular period of time. You should be interested in whatever phase of biology may come to your attention. In this connection biology is a lifelong study, either vocationally or avocationally, according to choice.

Adopt a biological hobby. Photography of plant and animal life can develop one's knowledge of biology very rapidly. Other hobbies might include the field of conservation of wild flowers, birds, mammals; extinct animals and plants, and those which are becoming exceedingly rare.

Plant a garden. The most dominant biological pastime down through civilizations has been the activity of gardening. Everyone benefits from it. If it is vegetable gardening it furnishes food. Other gardens are recommended for their aesthetic qualities,

and are lauded for their healthful activity possibilities. Knowledge of gardening grows rapidly with the years. The production of one crop of radishes makes one feel, the next year, like a veteran gardener with a storehouse full of know-how.

START A LIBRARY. The formation of a library does not need to be a lavish outlay of money at one time. It does mean the gathering together of textbooks, magazines with a biological theme, pamphlets of a similar nature, and other biologicals of a related character in one accessible area. You will be surprised with the speed with which your library will grow in size when you formulate a plan for its improvement and development.

IS SUCCESS IN BIOLOGY IMPORTANT? The people of biology believe that it is. In our opening paragraph we stated "biology is life and living." It always will be. In this regard everyone respects LIFE and holds it in high esteem. They also enjoy LIVING and want to continue to do so. For a good life one must learn living as an art.

WHAT YOU CAN DO ABOUT IT. The success suggestions mentioned are approaches you may make to the subject. There are no short-cuts to success but there are aids. These should not be considered as goals, but as methods for easier learning. These are not to take the place of ordinary correct study habits. They do not in any way relieve scholastic application. They are to serve as a compliment and supplement to regular laboratory and classroom work.

Trivia for Teaching

HELEN FIELD WATSON
Senior High School, Mitchell, South Dakota

Every teacher eventually finds a few simple methods for successfully teaching certain parts of the work, judged on the percentage of students who remember. Whether the items mentioned in this article are important in teaching high school biology you are as able to judge as I.

When the class is studying circulation in the human body, connect the a of the words anterior and auricle with the a-shaped cavities of the heart, and the v of ventricle with the v-shaped cavities. Also, associate the a of arteries with the a in away from. When I discovered the V-A-V-A-c-plan I felt pleased with myself. Perhaps others have thought of it long ago. The first V is for Vein. In no two places in the circulation do two V's or two A's come together. Always it is Vein-Auricle-Ventricle-Artery-capillary-Vein, etc. Charts with their blue and red coloring plan are apt to be misleading. But the V-A-V-A-plan always works in the systemic circulation.

You may not consider it important to remember average lung capacity. It interests students and helps to develop better posture, I feel. We use a wide-mouthed glass jar of a gallon or gallon-and-a-half capacity. There should be several glass tubes which can be sterilized, to slip into the long rubber tube for mouth-pieces. The jar is marked conspicuously with adhesive tape to show every 100 cu. in. when inverted. Assuming the biology laboratory has at least one sink, proceed by the water-displacement method, having a student inhale all the air he can then exhale into the tube to see how much water can be displaced from the jar. A few students will be able to empty the 231 cu. in. and they will remain proud and extra-chesty for a week following. When computing

capacity, add half as much as that expelled for the residual air. Every student wishes to try it—some after school.

Some educators in the field of science have advised classroom teachers not to bother much about classification. Students, they said, do not want to know what a thing is, but how does it work. This may be true in some fields of science and with some ages, but it is not true of biology students in high schools. Year after year, five sections a day of biology students have entered the laboratory to inquire of a strange object on my demonstration desk, "What is it?" They never ask first how it breathes or how its blood circulates. The second question is, "Where did you get it?" For that reason we keep lists of specimens brought in.

By basing the teaching of plants or animals on their classification the student learns many times what he could learn about a single living thing. Taxonomy should not be carried to extreme during the year of beginning work, but it makes a wonderful framework for knowledge. Since students are to learn the scheme of classification it is important to remember the order of terms—kingdom, phylum, class, order, family, genus, species. This is difficult. Then use the old method of devising a sentence the words of which begin with k.. p.. c.. o.. f.. g.. s.. . Sub-phyla and other subs will naturally fall into the right place. For several years my students have learned this by the catchy sentence: Kathryn pulled candy on Friday. Great Stuff! Many others have been devised but none has helped as has this one.

As to the value of sealed gardens for teaching the cycles of oxygen, nitrogen, and water I have written before in this magazine.* Balanced aquaria help also in theory and in aiding a young fisherman in keeping his bait alive.

We use frog dissection as an introduction to the study of human anatomy and physiology, rather than as a study of a low vertebrate. "There is nothing like so interesting to ourselves as ourselves." The differences in anatomy only serve to help students to remember functions.

Both boys and girls should learn to use a clinical thermometer. If the girls get this in Homemaking the boys can get it in Biology. First come the instructions for cleaning, shaking down, reading. Then let each student take and read at least one other student's temperature or his own. This can be done while other laboratory work is going on.

Have yardsticks fastened permanently to a doorway in the laboratory for making records of each pupil's height. Do this in early September and again in early May, two-thirds of a year. Fifteen-year-olds like it, and I think it is a reminder of good posture. Many come in the next year to measure and ask me to look up the record.

Walking is the activity we engage in most. Yet do you know any place where this is taught our pupils? The Englishman says that most Americans walk incorrectly, "In two lines," and we can readily note this from footprints in the snow or by walking behind a person. If you know how to walk, to stand, to sit, have a lesson on this. You may be able to do it by illustrating faulty posture.

Demonstration experiments on the senses should have two results: Knowledge of more than "the five senses," and wider appreciations. One student attendant at a public movie-theater asked ten patrons in succession how many senses we have. Eight said unhesitatingly that we have five, one thought

*"Silent Teaching," *American Biology Teacher*, Vol. 7, No. 7, p. 149, Apr. 1945.

more than five, and one said "at least ten." To students who know more about these several avenues of learning and enjoyment come new appreciations. Why not enjoy balance and temperature? Also, he will do better writing and less monotonous conversing than the person who tells only what he sees.

Have students keep note books for the value to themselves, not just to impress teachers. Eventually they find the notes more useful if orderly, with properly headed pages and a proper table of contents. Research experiments should be recorded for others. And distinguish between research experiments and demonstration experiments. Before the end of his first year in biology a student should know the value of identical set-ups in a controlled experiment.

Some texts explain Mendel's Laws of Unit Character, Dominance, and Segregation by representing all four genes involved with capital letters. Better to make the recessive a small letter, the dominant a capital, and the results are much more easily interpreted. Any group of students can rate 90% accuracy in manipulating one pair of characters by Mendel's Laws. I never feel that the knowledge is worth much, for every plant or animal has more than one pair of hereditary characters. But it illustrates a principle and if attempted at all it should be learned, not guessed at.

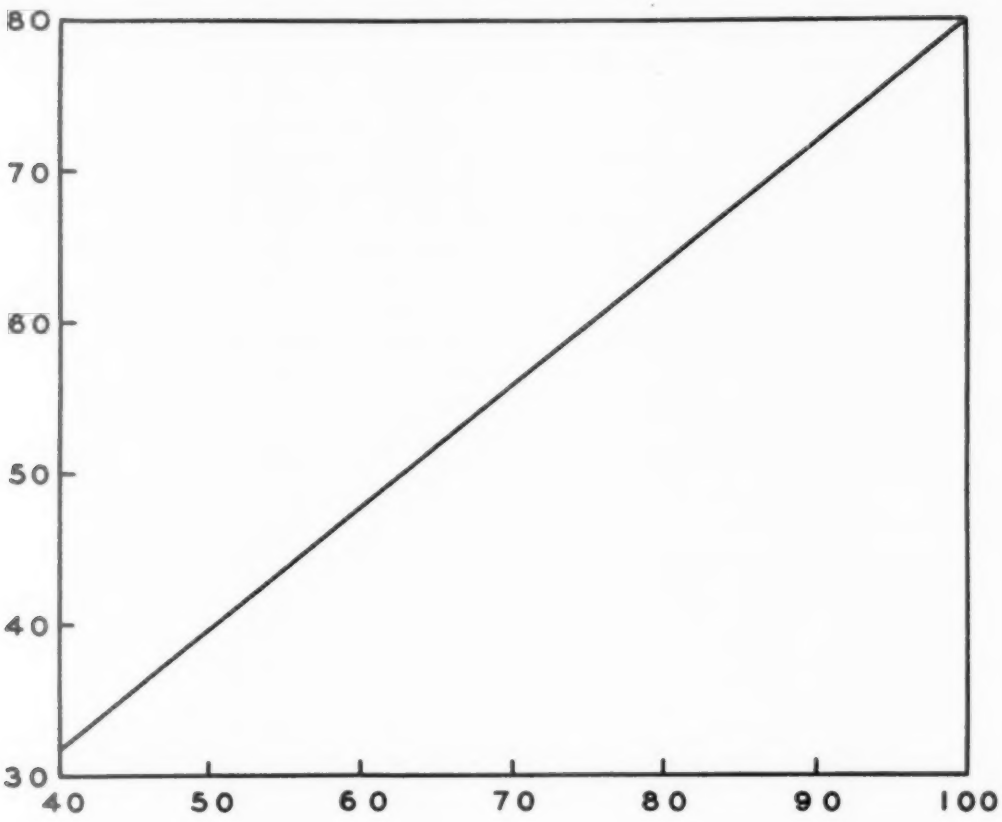
Some high school students sneeze widely and openly down some neighbor's neck. This may be brought up by a discussion of the relative merits of cloth handkerchiefs and paper handkerchiefs and they will get the idea. Or it may just be brought up. But many do not know: both sides of the nose should not be held shut at the same time in an attempt to open clogged Eustachian tubes; the mouth should be rinsed while brushing teeth in order to dislodge food from between cheeks and gums; that continuous sweets in the saliva due to the use of soft drinks, gum, candies, continuous lunches, invite dental caries. These are embarrassing to mention to self-considered adults. But even the over-worked ear specialists and dentists want young people to know these facts.

Truly these are trivia among all the other things which must be learned and taught during a year of beginning biology. But our lives seem to depend on trivia.

A GRAPH AS A TIME SAVER IN GRADE CALCULATION

Although the use of graphs in making calculations is common in some fields, few teachers seem to take advantage of this time saving method of calculating grades on a percentage basis when the total possible points does not equal 100. The construction of a graph for this purpose using regular graph paper is a simple matter.

The illustration shows a straight line graph for converting numerical scores of a test having a maximum possible score of 80 to percentage grades. Since no scores were below 35, the vertical scale for scores starts with 30 and goes up to 80. Since it is obvious that the lowest percentage grade is then somewhat above 40, the horizontal scale for percentage grades starts at 40 and goes up to 100. In order to construct a line which will provide a per cent grade for each score grade on this test, 40% of 80 (i.e., 32) is taken as the beginning point of a straight line on the left score scale and the line is drawn from this point to a point representing the highest possible score on the vertical axis (80) and 100% on the horizontal axis. By using graph paper with



20 lines to an inch, which would not reproduce well in a small illustration, each line may count half a point and grades read to half a per cent. To determine the grade corresponding to a score of 66.5, for example, instead of arriving at 83% by the devious process of dividing by 4 and then multiplying the result by 5, one simply glances in a straight line from 66.5 on the vertical score scale to its intersection with the drawn line and down in a straight line to the corresponding percentage grade on the horizontal scale.

John A. Freeman,
Newcomb College of Tulane University,
New Orleans, Louisiana

SYMPOSIUM ON PREMEDICAL EDUCATION

Alpha Epsilon Delta, the national premedical honor society, in cooperation with the American Association for the Advancement of Science, the American Society of Zoologists and Beta Beta Beta Biological Fraternity, will hold a luncheon and symposium at the Benjamin Franklin Hotel, Philadelphia, Pa., December 28th, on "Premedical Education and Social Health." Eric H. Faigle, Dean, Syracuse University, will preside at the program.

Attention will be focused on the medical problems which emphasize the importance of the social sciences in the premedical educational program. All persons interested in premedical education and student guidance are invited to attend and participate in the discussion.

Reservations for the Luncheon—Price $3.00, including gratuities—may be made by calling Mr. Robert Bennett, Sales Office, Benjamin Franklin Hotel, or in advance, by writing to Dr. Maurice L. Moore, 37 Whitemarsh Road, Ardmore, Pa.

PHILADELPHIA MEETING

(Skeleton Program—detailed program appears on page 158 of the November issue)

Thursday, December 27

8:00 A.M. Coral Lotus Room, Adelphia Hotel, Board of Directors
9:00 A.M. Crystal Room, Adelphia Hotel, Preview of Biology Films
10:00 A.M. Crystal Room, Joint Session of Science Teaching Societies, planned by NABT
2:00 P.M. Jefferson Room, Adelphia Hotel, Panel Discussion on Continuity of the Biology Programs
6:30 P.M. Buffet Supper, North Garden, Adelphia Hotel
10:00 P.M. All-Societies Mixer

Friday, December 28

8:00 A.M. Coral Lotus Room, Conservation Project Committee
9:00 A.M. Crystal Room, Preview of Biology Films
10:00 A.M. Joint Session, planned by ANSS
12:30 P.M. Jefferson Room, NABT Luncheon
2:00 P.M. Jefferson Room, Conservation Education Workshop
8:00 P.M. Coral Lotus Room, Meeting of NABT Conservation Committee, Executive Committee, Regional and State Chairmen

Saturday, December 29

8:00 A.M. Junior Room, Meeting of Membership Committee and Editorial Board
9:00 A.M. Crystal Room, Preview of Science Films
10:00 A.M. Crystal Room, Joint Session, planned by NSTA
2:00 P.M. Jefferson Room, NABT Program

Sunday, December 30

8:00 A.M. Joint Field Trip, NABT and NSTA

A Statement of Principles and Recommendations* as a Guide to

Cancer Education

In Colleges and Universities

WHY CANCER EDUCATION?

There are many health and welfare problems which remain unsolved in spite of the spectacular advances of the medical sciences in the past 50 years. In fact, these advances have created new problems the solutions of which lie largely in the sphere of social action. Our relative control of epidemic, infectious and nutritional diseases is resulting in a population age-shift in the direction of longer life, so that the "degenerative diseases," with all their chronicity, invalidism and socio-economic burdens are becoming health concerns of the first order. Each of these separate health problems has its own pressure group which apeals for funds and for volunteer leadership thus creating a scene as competitive as a Bombay bazaar. Obviously, some criteria are necessary for a judicious selection of what is of greatest importance.

Cancer is unique by virtue of this triad: (1) its almost inevitable mortality if untreated; (2) the critical importance of the factor of time in treatment; and (3) its trivial early signs—indistinguishable from a host of relatively insignificant complaints which are common to us all.

While cancer is generally fatal if untreated, or if treated late, the fact is that cancer is among the most curable of the major causes of death. When cancer is properly treated while it is confined to the breast, 80% cures (five-year survivals without evidence of disease) are possible. When cancer of the

*Prepared by The College Program Advisory Committee and The American Cancer Society.

uterus is treated early, 70% can be cured. When cancer of the larynx is treated while the disease is confined to one vocal cord, it can be cured in 75% of the cases.

Yet because most cancer is not treated early there exists a striking dichotomy between curability under optimal conditions and cures actually being achieved. Countrywide, we are curing about 30% of breast cancer, 20% of uterine cancer, 15% of cancer of the larynx. The reason is not that we lack the technical ability, but that delay between the appearance of cancer's signs and the institution of treatment has prevented application of that ability. This delay is primarily attributable to the patient himself, because it is the patient who first becomes aware of trouble and who must take the first step.

Motivation—taking the first step—is complicated by the usually insignificant nature of the early signs and symptoms. The average patient with cancer of the larynx delays 3½ months after he becomes hoarse before asking a doctor to help him. Men with cancer of the bladder wait 5 months after the appearance of blood in the urine before seeking professional opinion. Similar delays are identified with every found cancer, even that of the skin (13 mos.).

The reduction in this critical delay is the objective of cancer education. No biological test (at present), no legislation, no professional prescience will help. It is clearly each individual's own responsibility to know the commoner early signs and symptoms of cancer, and to know the pristine importance of action when they appear.

The foregoing suggests that, of the major health problems facing us, cancer is susceptible of the earliest and most substantial relief.

Cancer education at the college level will accomplish three things: (1) It will provide information which may save his life if he, or someone close to him, develops cancer. (2) It will provide the individual with a focal point on which the sense of responsibility for the social group (which we hope is characteristic of educated people) may crystallize in the form of leadership in welfare activity. (3) It will provide those destined to become physicians the opportunity to study the social significance of disease and the application of social approaches to the solution of the problems of disease—and, as pointed out before, these are becoming as important as incisions and dosage.

Principles and Recommendations

"To Maintain and Improve His Own Health and to Cooperate Actively and Intelligently in Solving Community Health Problems"—From Report of the President's Commission on Higher Education.

I. The above statement is one of the major objectives of general education. It makes clear the responsibility of every college and university to establish and maintain a program of health education and service.

II. Because cancer is a leading cause of death, and in view of the degree of individual responsibility necessary for its control, cancer education should be given a prominent place in the total college health program. Education concerning cancer should be organized as an integral part of that program rather than as something separate.

III. Colleges and universities are prepared to and should accept responsibility for:

A. Giving every member of the college community the information necessary for his own protection from cancer;

B. Developing a realization of the part each person can play in helping his

friends and neighbors to protect themselves;

C. Developing in every person an appreciation for, and a willingness to help with, the nation-wide program of cancer control;

D. Inspiring qualified students to prepare for research or other service in cancer control;

E. Providing an adequate student health service program and stressing its attendant educational function; utilizing the medical examination of all students to teach the value of periodic physical check-ups now and later; developing the habit of an annual physical examination which will contribute to the maintenance of optimum health and the early detection of chronic disease, including cancer;

F. Acquainting students with health services and resources, including facilities for diagnosis and treatment;

G. Providing for research to be undertaken in the chemical, physical, and biological laboratories within the college;

H. Providing for educational research in field problems such as:

1. The evaluation of the effectiveness of health education in schools, colleges and the community.
2. Surveys concerning the extent to which students' families have had first-hand contact with cancer, and determining what they know about the disease and what can be done about it.

IV. To be most effective, the cancer education program, like the total health program, should be planned by representatives from the various groups in each college community—administrators, faculty members, students, custodial and service staffs—and also representatives of community groups. Such joint planning will determine:

A. What information should be made available, what attitudes and behavior patterns fostered;

B. Where these will be incorporated—to what extent in courses; to what extent in health services; to what extent in advisement and counselling and in research;

C. Who will be responsible—faculty members, students, service staff, administrators, community agencies and others;

D. What methods and materials will be utilized;

E. What resources are to be used—departments and campus organizations; community, state and national agencies.

V. The cancer education program in a college or university should be planned to influence all persons in the area served by the institution as well as those in the campus community.

VI. Adaptations in the cancer education program should be made as needed to enable each institution or department to serve its particular function. For example—the teacher-preparing institution may be expected to include items different from those stressed in other professional schools or in the liberal arts colleges.

VII. Additional leadership on local, state and national levels is needed if cancer is to be controlled to the degree which is now possible. Every institution of higher education has an obligation to contribute to this leadership. Students should be encouraged to serve as volunteers in community organizations such as the American Cancer Society, the Red Cross, etc., within the college community and in their own communities later.

Four publishers, Thomas Y. Crowell Co., W. W. Norton and Co. Inc., Oxford University Press, and Rinehart and Co. Inc., are cooperating in the maintenance of a Joint Directory of Higher Education. The address is Joint Directory of Higher Education, 432 Fourth Avenue, New York 16, N. Y.

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